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STAFF APPRAISAL REPORT

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

APRIL 23, 1990

Country Department II
Asia Regional Office

CURRENCY EQUIVALENTS

Currency Unit - Korean Won (W)

US$1.00 = W 692
(March 1990))

WEIGHTS AND MEASURES

Metric System

FISCAL YEAR

January 1 - December 31

ACADEMIC YEAR

March - February

ABBREVIATIONS

APC	-	Academic Promotion Committee
ARPD	-	Academic Research and Promotion Division
EFB	-	Education Facilities Bureau
ELPD	-	Education Loan Projects Division
EPB	-	Economic Planning Board
ICB	-	International Competitive Bidding
KEB	-	Korea Exchange Bank
KOSEF	-	Korea Science and Engineering Foundation
KRF	-	Korea Research Foundation
MOE	-	Ministry of Education
MOST	-	Ministry of Science and Technology
O&M	-	Operation & Maintenance
OSROK	-	Office of Supply, Republic of Korea
PCR	-	Project Completion Report
PCC	-	Project Coordinating Committee
PMO	-	Planning and Management Office
PPAR	-	Project Performance Audit Review
R&D	-	Research and Development
S&T	-	Science and Technology
STEB	-	Science and Technology Education Bureau
UEO	-	University Education Office

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

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This report is based on the findings of a preappraisal mission which visited Korea during June 1989 and an appraisal mission consisting of Messrs. W.E. Rees (mission leader), S. Z. Sung and J.J. Stewart (consultants), which visited Korea during October 29 - November 10, 1989.

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KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Loan and Project Summary

Borrower	:	Republic of Korea
Beneficiaries	:	Selected universities
Amount	:	US$45.0 million equivalent
Terms	:	Repayable in 15 years including 5 years of grace at the Bank's standard variable interest rate
Re-Lending Rate	:	To public universities as budget transfers from the Ministry of Education (MOE) and to private universities as subloans by the Government for 15 years including 5 years of grace at one-half of the Bank's interest rate.
Project Description	:	The overall objective of the project is to assist selected universities in broadening and deepening their basic research programs in priority fields in science and technology in order to strengthen their capacity to support technological innovation. The project also aims to strengthen science teacher education through enhancing research capacity in this field which in turn would strengthen the base of science education in the secondary schools. The project would include specialized equipment to be financed by the Bank (US$45.0 million including contingencies) and complementary inputs related to the equipment to be financed by the Government (US$15.0 million). The proposed project would finance: (a) equipment for graduate schools to assist in strengthening the research capacity of individual departments of science and engineering; (b) equipment for use in joint research projects involving more than one university to increase the scope for research cooperation among institutions; and (c) equipment for departments of science education to strengthen research in areas of pedagogy and in particular science subjects. The Government would finance complementary inputs related to making the equipment operational and maintaining it thereafter, namely transportation and installation costs, O&M and consumables.
Benefits and Risks:		The project would strengthen the capacity of selected universities to support technological innovation in priority fields by enhancing their ability to undertake basic research. This in turn would help to reduce

Korea's dependence on imported technology and in the longer run strengthen its ability to maintain the pace of industrial development and remain competitive in export markets. The project would also strengthen science education in the universities, leading in time to higher quality training for science teachers which in due course would strengthen the base of science education in Korea. There are no major risks associated with the project.

Project Costs:

	Local	Foreign	Total
	----- US$ million -----		
Institution			
Graduate Schools of Natural Sciences	3.8	13.1	16.9
Graduate Schools of Engineering	3.8	13.1	16.9
Joint Research Facilities	2.4	9.1	11.5
Departments of Science Education	1.3	4.4	5.7
Baseline Cost	11.3	39.7	51.0
Contingencies			
Physical	0.5	2.0	2.5
Price increase	1.6	4.9	6.5
Subtotal	2.1	6.9	9.0
Total Project Cost /a	13.4	46.6	60.0

Financing Plan:

	Local	Foreign	Total
	----- US$ million -----		
Government	13.4	1.6	15.0
IBRD	-	45.0	45.0
Total	13.4	46.6	60.0

Estimated Disbursements:

Bank FY	1991	1992	1993	1994	1995	1996
	---------- US$ million ----------					
Annual	3.0	11.0	17.0	9.0	4.5	0.5
Cumulative	3.0	14.0	31.0	40.0	44.5	45.0

/a Does not include duties, taxes and fees estimated at US$3.6 million.

Economic Rate of Return: Not applicable.

Map: IBRD No. 22115

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

I. TRENDS IN RESEARCH AND DEVELOPMENT

1.1 The restructuring of Korean industry towards technology-intensive production over the past two decades has required a rising commitment to investment in research and development (R&D). The increase has been dramatic, with expenditures on R&D rising from 0.3% of GNP in 1973 to 2.4% in 1988, a level not appreciably below those of the advanced industrial countries. It is planned that the proportion will increase further to 3% by 1991 and 5% by 2001. In the early years, investment in industrial R&D was led by the public sector research institutes, with the private sector and especially the universities playing relatively minor roles. In 1976, the public sector research institutes accounted for 72% of total R&D expenditures compared with 25% for the private sector and 3% for the universities. By 1986, the provision of tax and other financial incentives to the private sector to encourage R&D investments had increased its share of total R&D expenditures to just over 70% with the research institutes accounting for about 20% and the universities 10%.

1.2 In recent years, industrial restructuring towards more technology-intensive production has also moved Korea from a stage characterized by the local assimilation and improvement of imported technology, to one which is emphasizing increasingly the pursuit of indigenous technological innovation. During the period of technology assimilation, Korea concentrated on mastering production technologies and the need for technological innovation was modest. But as Korea continues its industrial development towards technologically sophisticated, higher value-added production this trend must be accompanied by a strong commitment to create the capacity for technological innovation and to support the programs in basic research which underlie it. Reinforcing this need is the growing reluctance of leading industrial countries to continue exporting advanced technology to an increasingly successful competitor.

1.3 Investments in basic research have increased rapidly in recent years, with total expenditures almost tripling between 1983 and 1987, although basic research as a proportion of total R&D expenditures has remained almost constant in this period at about 17%. Nevertheless, this proportion compares favorably with the major industrialized countries whose expenditures on basic research as a proportion of total R&D expenditures in 1986 were: USA, 12%; Japan, 13%; Federal Republic of Germany, 19%; and France, 21%. It is planned that basic research will account for 20% of total R&D expenditures in Korea by 2001. The universities have the prime responsibility for basic research programs according to the Government's research policy which calls for a rough division of responsibility for R&D activities between the universities (basic research)1/ and the research institutes and industry for applied and developmental research. The universities account for 49% of expenditures on

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1/ The universities do not focus exclusively on basic research. Expenditures by research activity in the universities in 1987 were: basic, 77%; applied, 18%; developmental, 5%.

basic research but it is industry that dominates the research sector accounting for 22% of basic research, 56% of applied research and 79% of developmental research.

1.4 The rapid rise in overall R&D expenditures from Won 16 billion in 1973 to Won 1.9 trillion in 1987 was accompanied by a much smaller but still substantial growth in the number of researchers, which increased from 6000 to 53,000 in the same period. This implies a significant increase in annual expenditures per researcher - in fact an increase of nearly 14 times was achieved during the period. The stock of researchers has also increased in quality, at least in terms of the proportion of researchers with graduate degrees, which increased from 46% to 53% between 1977 and 1987. In terms of numbers, graduate degree holders more than quadrupled.

1.5 The foregoing trends reflect a policy in technology development which calls for a rapid increase in R&D investments, a dominating role for industry especially in applied and developmental research, a significant role for the universities in basic research and a strong commitment to train the research personnel necessary to support the R&D expansion. These policies have, for the most part, been successful but the weakest link lies in the universities. While the universities have a preponderance of graduate R&D personnel, limited research funds have kept per capita research spending at only about one-quarter that of industry and the research institutes. In the universities, 94% of researchers have graduate degrees, compared with 67% in the research institutes and 22% in industry. About 50% of all graduate R&D personnel are working in the universities. Per capita research expenditures of research staff are about US$70,000 in the institutes and industry, compared with just over US$17,000 in the universities.

1.6 Financial constraints have also led to shortages of research equipment in the universities and this has hampered both the quality as well as the quantity of research. However, there is an improving trend. In recent years greatly increased public and private support for university research has led to a rapid rise in expenditure per researcher - since 1981 such expenditures have more than tripled. The Bank has also played a role in this improvement under the second education sector loan (2427-KO) which assisted in strengthening research and graduate programs in science and technology in the universities.

II. SCIENCE AND TECHNOLOGY RESEARCH IN THE UNIVERSITIES

A. Graduate Education in Science and Technology

2.1 The foundation of Korea's research effort lies in its graduate programs in science and technology, the products of which largely determine the quality and direction of research activities.2/ In line with the pursuit of

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2/ The other source of high-level R&D personnel is the government-subsidized program to repatriate Korean scientists and engineers living overseas, mainly in the United States. The annual flow of returnees is currently about 150-180. This program was assisted under Loan 2427-KO.

increasing technological sophistication in recent years, graduate programs in science and technology have expanded rapidly. Between 1982 and 1988, the number of graduate programs increased by over 40% and enrollments rose at a similar rate; enrollments in doctoral programs increased at a higher rate of nearly 60% during the period. The output of candidates with graduate degrees in science and engineering has increased at an even higher rate--nearly 2.4 times between 1982 and 1988. Again doctorates showed a still higher increase--about 3.2 times during the period. These trends are indicative of the strong emphasis Korea is giving to producing the high-level R&D personnel necessary to support ambitious plans for technological development. The particularly high rates of increase in doctoral enrollments and graduates reflect both the priority for pursuing state-of-the-art technology as well as strengthening the faculty in graduate schools of science and technology.

2.2 The rapid expansion of graduate programs in recent years has led to some qualitative problems which the Government is currently addressing. Standards are uniformly high in only a relatively small number of universities. Elsewhere many graduate programs are undersize in terms of enrollments and faculty and therefore lack the "critical mass" to be viable teaching and research units. Graduate programs averaged 15 students in 1988, unchanged from the situation in 1982. This means that as the number of programs expanded rapidly in the '80s, there was little concentration on expanding large programs but rather a proliferation of small ones. The Government is now pursuing a policy of concentrating resources in a limited number of graduate schools to ensure high quality and cost effective performance in teaching and research.

2.3 The quality of faculty is improving at least in terms of the numbers holding doctorates. Currently, about 62% of graduate school faculty have a doctorate compared with around 50% in the early '80s. This improvement has benefitted substantially from the Government's repatriation program (para. 2.1). Contact hours for faculty have traditionally been very high in Korean graduate schools of science and engineering, averaging around 12-15 hours per week. However, the average had been reduced to about 11 hours per week by 1987 through expanded faculty recruitment programs and a target of 10 hours per week is expected to be achieved by 1990.

B. Financing and Selection of Research Projects

2.4 There are two major sources of financing for university research programs in Korea - the Ministry of Education (MOE) and the Korea Science and Engineering Foundation (KOSEF) under the Ministry of Science and Technology (MOST). These agencies contribute about equally to research financing which has grown rapidly in recent years as indicated below:

University Research Funds (Won billion)

	1985	1989	Multiple
MOE	4.7	19.0	4.40
KOSEF	4.5	20.3	4.50
TOTAL	9.2	39.3	4.27

The MOE allocates funds for research to the following three categories:

1. to the universities directly for reallocation by university administrations to individual professors;

2. to the universities for reallocation to selected university - affiliated research centers; and

3. to individual or groups of professors who are awarded grants directly on the basis of approved research proposals.

The relative shares of the research budget allocated to the three recipient groups remain fairly constant from year to year. In 1989 the proportions were 32%, 41% and 27%, respectively. Funds are allocated according to a mechanism explained below, which in general is working satisfactorily.

2.5 Responsibility for the research budget within MOE lies with the Academic Research and Promotion Division (ARPD) which compiles requests for research financing from the universities (categories 1 and 2) and balances these in aggregate against the amount it considers feasible to allocate for individual requests under category 3. This exercise takes place within a total research budget ceiling provided by the Planning and Management Office (PMO) of MOE. The ARPD is assisted in its allocation of research funds by the Academic Promotion Committee (APC), consisting at present of 35 professors. The APC is considered to have a strong influence on the distribution of research funds. It makes recommendations on funds allocation by discipline and field of research for the three categories and therefore determines the relative share of these categories within an annually increasing envelope. As noted above these shares have remained fairly constant in recent years. The APC is well-informed regarding national priorities in research in science and technology as defined in the long-term plans of the Ministry of Science and Technology (MOST). Familiarity with these plans also keeps the more astute university administrators and professors informed of national priorities, thus enabling them to formulate relevant proposals. The result is an overall research program which is reasonably consistent with national priorities.

2.6 On receipt of the research budget from MOE,3/ the university presi-

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3/ The research budget as proposed by ARPD is reviewed and adjusted as necessary by PMO and then approved by the Minister for Education. It then passes to the Economic Planning Board (EPB) for review and approval and then to the State Council for approval before being debated and approved by the National Assembly.

dent, usually in consultation with his deans, allocates research funds under category 1 among the various faculties and individual researchers. Although there are no uniform criteria for allocation applied nationally, due regard is given in most universities to the qualifications and competence of researchers and the merit of their proposals in relation to the research priorities of the faculty and university. Less latitude exists for the allocation of research funds to university-affiliated research centers under category 2. These have typically been identified by the universities in their original requests to MOE and the research grants are usually made on an earmarked basis to particular research centers. The allocation of funds to individual researchers under category 3 is the responsibility of the Korea Research Foundation (KRF) which acts as the agent for MOE. KRF publishes annually a notice to universities requesting research proposals from individual professors for possible MOE funding. Proposals are subject to an administrative review which includes the qualifications of the professor and a peer review by two outside experts each of whom assigns a score. A supplementary review is held if there are significant differences in these scores. An overall committee recommends awards on the basis of the scores.

2.7 The typical MOE research grant, whether awarded by KRF or allocated by the universities, is about Won 4 million or about US$5,800. Support for a joint research project is more typically in the range of Won 8-10 million. Joint research proposals are usually submitted by two or more researchers in different disciplines in the same university or by a university professor and one or more researchers in a private research institute. Multi-year projects have to be re-funded each year but this generally does not pose any problems of funds availability. Research funds provided by MOE are used to finance software items, mainly consumable materials and financial support for graduate students. Although MOE funds cannot be used for the purchase of equipment, they can be used for the purchase of spare parts. The latter increases the control a researcher has over his work by obviating the need to obtain parts through more lengthy centralized procurement procedures.4/

2.8 KOSEF was established in 1977 to provide research grants for basic and applied research, mainly in the universities, and to finance graduate research fellowships and grants for advanced study abroad. KOSEF is funded mainly by budget allocations through MOST (73%) with additional income derived from an endowment fund and donations. KOSEF employs rigorous selection procedures for financing research projects and regularly reviews major research fields to ensure that the overall direction of its research funding is consistent with national priorities as defined in MOST's science and technology plans. KOSEF finances two types of research - individual grants to university researchers and grants for mission-oriented research undertaken by research teams on a research topic predetermined by KOSEF in conjunction with MOST.

2.9 In the case of individual research grants KOSEF invites proposals from university researchers. Each proposal is then sent to three experts who review it in terms of standard criteria related to the relevance of the proposed research, the qualifications of the researchers, the adequacy of

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4/ However this advantage can be offset if local suppliers do not maintain adequate stocks of parts (para. 2.17).

research facilities, etc. The results of this review are then sent to specialist panels of 5-7 experts in a given discipline. There are 17 such panels servicing KOSEF and they are responsible for providing a complete review of all research proposals and a list of recommendations, grouped by discipline, for financing. Selected proposals are then sent to KOSEF's Program Development and Review Committee for final decisions. In making its decisions the Committee also takes into account broader criteria such as the balance between engineering and basic sciences and the relative priority of different scientific disciplines. Similar procedures are followed in the case of mission-oriented research, which currently accounts for about two-thirds of KOSEF-financed research. However, research topics have already been identified by KOSEF in consultation with MOST and proposals from research teams must conform with the list of topics.

C. Research Evaluation

2.10 The evaluation of research projects assisted by MOE funds allocated directly to the universities, is the responsibility of the universities themselves. There are no standard evaluation procedures in force and practice varies from institution to institution. However there is a strong tendency for evaluation to emphasize the numbers of publications resulting from research projects with increasing weight being given to whether the paper was published in a university's own publication, in a Korean journal or in an international journal. Thus a journal's decision to publish acts as a proxy for evaluating the quality of a research project with the highest merit being awarded to papers published internationally. In engineering, especially in more complex projects, evaluation criteria also include the numbers of patents issued and the numbers and amounts of commercial contracts awarded. For some projects, where appropriate, the impact of the project in furthering the education of graduate students is also taken into account.

2.11 The KRF is responsible for the evaluation of all research projects for which it awarded MOE financing. Publication of a paper in a professional journal is sufficient evidence of success for KRF and no further evaluation is required. Papers that are not published however, are subjected to rigorous scrutiny by the two experts assigned by KRF to evaluate the project when it was in the proposal stage and who originally recommended its financing by MOE (para. 2.6). The paper is evaluated on the basis of the degree to which the stated objectives of the project were achieved and a grade of A, B, or C is assigned to it. Papers given a C grade are reviewed by a second committee of experts which decides whether the grade is appropriate or should be lowered to a D. The president and respective dean of the university in which the research was conducted are notified by KRF of the projects assigned grades C or D. In addition, KRF publishes for the universities and MOE, an annual listing of all projects assigned C or D within the year. A researcher responsible for a C rated project is warned by KRF that his performance must improve if he is to continue to be considered for future MOE research assistance. A researcher responsible for a D rated project is declared by KRF to be ineligible for MOE research financing for five years.

2.12 For KOSEF-financed individual research grants, there is no formal requirement for a final evaluation. KOSEF requires copies of any publications resulting from research. If there are no publications, KOSEF notes this on

the record of the researchers and this is taken into account in any future applications for research funding. For mission-oriented research projects, a final report is prepared by the project team, reviewed by KOSEF and forwarded to MOST.

D. Relevance and Quality

2.13 Research in the universities takes place within an overall planning framework which is formulated by the Ministry of Science and Technology. MOST's planning function involves the preparation and implementation of a five year science and technology (S&T) plan which complements the five year national economic plan. The close links between the two plans ensure that the S&T plan reflects the country's economic and development priorities and also that the economic plan takes full account of the investment requirements of science and technology. MOST is also responsible for long range planning and strategy in S&T to the year 2000. Major priority areas have been identified in which R&D investments will be concentrated such as microelectronics, specialty chemicals, biotechnology, etc. The long range plan provides the framework for the five year plans which in turn define the R&D programs necessary to meet the long-term objectives.

2.14 Reference is made to planning objectives during the selection of research projects and this ensures a degree of relevance to national needs (para. 2.5). University research which is carried out within the context of the program of "national projects" is highly relevant to overall objectives in science and technology. This program, financed by government and industry and carried out by public and private research institutes in conjunction with the universities, was initiated in 1982 and focuses on developing technology in key strategic areas which are beyond the capacity of industry alone. National projects are carefully targeted on priority areas of technology development according to a list of appropriate research topics which is prepared annually by MOST. The latter is also responsible for obtaining Government approval of the projects and for providing the Government's share of financing.

2.15 It is difficult to assess the overall quality of research in the universities because each university is responsible for evaluating its own research projects and there are no standard procedures in force throughout the university system (para. 2.10). However, there is no doubt that the R&D effort in Korea has made a vital contribution to the country's rapid industrialization and within this context the universities have played an important, if subsidiary, role. The universities bring to research the major advantage of a highly qualified staff--around 60% of all R&D personnel with graduate degrees are university faculty. In addition the financing of university research is improving. Whereas limited research funds kept per capita research spending at only about one-quarter that of the national research institutes and industry, in recent years greatly increased public and private support for university research has led to a rapid rise in expenditure per researcher--since 1981 such expenditures have more than tripled. Thus the combination of improved financing for a highly qualified research staff can be expected to raise the quality of research.

2.16 On the other hand, several factors tend to detract from increasing the quality of research. Contact hours for faculty have been traditionally

high in Korean graduate schools although the situation is improving (para. 2.3). The number of graduate students being supervised by faculty members varies widely but can be as high as 15 graduate students under the supervision of one faculty member. There is a tendency for the burden to be higher in the less-prestigious universities than in the major universities. Nevertheless this burden is generally carried only during the eight-month teaching year which is divided about equally between teaching and research. During the remaining four months faculty are expected to devote most of their time to research. Thus faculty spend about two-thirds of their time on research activities.

2.17 Support services, especially access to computers, is generally adequate but the quality and quantity of laboratory equipment is less so. Traditionally, Korean universities have relied upon foreign loans to finance equipment and thus have improved the situation in recent years especially through Bank loans and bilateral assistance from Japan. Nevertheless, the need to keep up with rapidly changing technology requires the continuous updating of laboratory equipment and this is not being achieved in many universities. The lack of spare parts also poses a problem. Researchers often underestimate the needs for parts replacement in their research proposals and funding of parts then becomes difficult. In addition many parts have to be imported and, since profit margins on parts are low, local suppliers often do not maintain adequate stocks leading to significant delays for researchers as parts are sought overseas.

E. Bank's Role in Education and Research

2.18 The Bank has assisted Korea's technology development efforts through substantial support for the development of technical and scientific education and research.5/ Bank lending has been consistent with Korea's needs and priorities in education and has closely paralleled the increasing sophistication of Korean industry. It was recognized that the restructuring of industry towards more skill-intensive, high-technology production would require the continuous expansion and upgrading of technical skills. Thus as industry developed towards greater skill-intensiveness, Bank assistance to education moved from support for craftsman and technician training through professional engineering education to graduate engineering programs and associated research activities.

2.19 The Bank's initial involvement in the sector under four loans/credits, focussed on the development of vocational and technical education at the secondary and postsecondary levels to strengthen the base of the system for producing technical personnel. Project performance audit reports (PPARs) for these projects concluded that they were in general well-conceived and successfully implemented. The reports also concluded that future projects would benefit from: (a) advanced project preparation before approval; (b) improved local management procedures to expedite procurement; and (c) greater focus on policy-analysis and evaluation. These lessons were built into the

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5/ The Bank has also provided major support to technology development through directly financing R&D programs, strengthening intermediaries which finance R&D and providing credit for industrial development in general.

two subsequent operations which were policy-oriented sector loans.

2.20 The first education sector loan (Loan 1800-KO) concentrated on upgrading junior technical colleges and university colleges of engineering and management through the supply of equipment, staff development and institutional improvements in curriculum development, manpower planning, equipment maintenance and academic accreditation. The PPAR for the loan (Report No. 7252; May 24, 1988) indicates that the major lessons learnt were: (a) a stable and responsible sector management agency was the key to successful implementation of the sector program; (b) the sector approach led to a quicker and more sustainable development of institutional capabilities; and (c) the additional time required for preparation was repaid in terms of more efficient implementation.

2.21 The second sector loan (Loan 2427-KO), which incorporates these lessons, supported improvements in graduate education in science and engineering, upgrading secondary school and college science programs, expanding graduate research programs and improving sector management, manpower monitoring and strengthening the financial base of private educational institutions. Implementation of the loan was satisfactory and it closed on schedule (June 30, 1989) with its major policy objectives having been achieved. A project completion report (PCR) for the project is currently under preparation. The Bank's positive role in Korea's education sector is documented in the OED report titled Review of the Impact of World Bank Lending for Educational Development in Korea (Report No. 5950; December 4, 1985).

2.22 The Bank's shift towards supporting research activities which was initiated with assistance to graduate research programs in the universities under Loan 2427-KO was continued under the first Technology Advancement Project (Loan 3037-KO). This project is strengthening the R&D capacity of two national research institutes which are focussed on assistance to small and medium industries. The project also strengthens education in an undergraduate center of excellence in science and technology through enhancing the ability of senior students to participate in research projects. The Second Technology Advancement Project which follows a similar design is ready for Board presentation. The project includes assistance to three national research institutes which focus on national standards measurement, genetic engineering and the development of energy and natural resources; it also assists in strengthening the research capability in a center of excellence in graduate education in science and technology.

2.23 There has been, therefore, a consistent theme to the Bank's assistance for education in science and technology as a means to supporting the overall policy of technology development in Korea. The Bank's efforts have followed three distinct phases beginning with project support for the expansion and quality improvement of vocational and technical education which focussed on the training of skilled craftsmen and technicians. The Bank then turned its attention to sector lending as a means to strengthening the policy framework in education in science and technology, improving the quality of engineering and science education at the undergraduate and graduate levels and strengthening the research environment in the universities. Bank assistance is currently in a third phase which has reverted to project lending and gives

emphasis to research activities in support of industrial R&D. The project approach is deemed appropriate again because a satisfactory policy framework has been established for education in science and technology, with assistance from the Bank's two sector loans. A similar situation exists for policies in technology development in general which have evolved over time with support from the Bank through industrial/technology development and finance operations accompanied by extensive sector work.

III. THE PROJECT

A. Origin of the Project

3.1 The Government included the project in its FY90 list of projects suitable for external financing and formally asked the Bank for assistance in December 1988. A Bank mission identified the project in March 1989. Most of the preparation work was completed by the Government according to guidelines formulated by the Bank. The project was preappraised in June 1989 and appraised in October - November 1989.

B. Project Rationale, Objectives and Scope

3.2 Bank support for technology development in Korea during the last decade has focussed mainly on financing R&D projects through financial intermediaries, strengthening those intermediaries and the development of technical and scientific education. More recently the Bank has started to assist R&D activities in the universities and the national research institutes. This support served Korea well as it mastered the assimilation of imported technology. But with the increasing reluctance of the advanced countries to export technology to Korea, which is seen as a rising competitor, the development of a capacity for indigenous technological innovation and a commitment to the basic research programs which underlie it are becoming essential if both the pace of industrial development and competitiveness in export markets are to be maintained. The proposed project would assist the universities in strengthening their ability to undertake basic research in science and technology, thereby enhancing their capacity to support the development of innovative technology. The project has been designed within a sound policy environment which was developed with considerable assistance from the Bank's two education sector loans (1800-KO and 2427-KO) which addressed policy issues in education for science and technology and strengthened research programming. The project would continue the assistance to graduate programs and research in science and technology started under Loan 2427-KO and the assistance to strengthening science education also included in that loan.

3.3 The overall objective of the project is to assist selected universities in broadening and deepening their basic research programs in priority fields in science and technology in order to strengthen their capacity to support technological innovation. The project also aims to strengthen science teacher education through enhancing research capacity in this field which in turn would strengthen the base of science education in the secondary schools.

The project would finance specialized equipment through the proposed Bank loan and complementary inputs (O&M, consumables, etc.) to be financed by the Government.

C. Project Design and Description

3.4 Korea's universities and colleges which number about 110 (80% private), enjoy a large degree of operational autonomy under the overall budgetary and planning authority of the Ministry of Education. Budgets are formulated by the universities and reviewed and consolidated into a higher education budget by MOE which covers the public universities and government support to private universities. MOE then makes appropriate recommendations to the Economic Planning Board. The higher education budget is processed through the State Council and ultimately approved by the National Assembly. The autonomous nature of the universities precludes MOE from directly selecting the universities which would participate in the project. MOE believes, however, that in the interest of equity, all universities should have a chance to be selected to participate in the project. Therefore objective criteria of selection are needed which would apply to all universities and would permit selection, from within the universities, of graduate schools of science and engineering, joint research facilities and departments of science education which are the ultimate beneficiary institutions under the project. Furthermore, given the diversity of research activities at the graduate level, which vary widely by discipline and research topic, equipment requirements for graduate schools and joint research facilities are more effectively identified as components of research projects. Thus research projects generate equipment lists. Given the many competing proposals for research constantly under review in the universities, suitable criteria would also be required for selecting research projects to be financed in the institutions to be assisted under the proposed project. This approach has the advantage of giving the responsibility for identifying research projects to those best qualified to do so, namely the universities.

3.5 Thus under the process to be followed in this project, equipment lists would be derived from the research projects selected from within the participating universities. Determination of the equipment to be financed by the Bank would follow three stages: (a) selection of participating institutions; (b) selection of research projects from within these institutions; and (c) formulation of equipment lists related to the approved research projects. This process will require two sets of criteria as indicated above. First, criteria to select participating institutions have been drawn up and include such quantitative measures as size and quality of staff, enrollments, research activities, etc. (Annex 1). Second, criteria have been formulated for the selection of research projects, including associated equipment lists, within the participating institutions. These include relevance of research to national and institutional priorities, adequacy of staffing, facilities and consumable materials, appropriateness of equipment to research design, utilization of graduate students, etc. Research proposals would be evaluated by panels of experts (para. 4.7) which would assign points to the proposals in accordance with the above criteria. Research proposals would then be eligible for financing in order of priority consistent with the assigned points (Annex 2). Guidelines would also be applied to the allocation of loan proceeds in terms of the distribution of funds between types of project institution, regions and public/private universities, and ceilings for the numbers of

schools would be included to ensure a reasonable concentration of funds. A minimum allocation per institution would also be applied to ensure that an adequate research impact would be achieved (Annex 3). During negotiations, the Government agreed that project institutions and research projects would be selected and loan proceeds allocated among institutions according to criteria and guidelines acceptable to the Bank.

3.6 The amount of equipment to be financed by the loan (US$45 million including contingencies) has already been determined by the Government and represents a fixed amount within the foreign borrowing program. The equipment forms the core of the project but in order to ensure that it is utilized effectively, complementary inputs must also be supplied. These would be financed by the Government and cover transportation and installation of equipment, O&M and consumable materials. The Government would also finance contingencies related to these components. Bank-financed equipment would be concentrated in four areas--graduate schools of natural sciences and engineering, joint research facilities and departments of science education. Equipment for the graduate schools would assist in strengthening the research capacity of individual departments of science (estimated cost including contingencies US$15 million) and engineering (US$15 million). Joint research facilities in science and engineering providing common access to researchers from different universities would also be strengthened through the supply of equipment under the project (US$10 million). This would also lead to increased research cooperation between universities. In departments of science education, equipment would strengthen research in areas of pedagogy and also in particular science subjects (US$5 million). This would lead in due course to the production of science teachers with a firmer understanding of teaching methods in science and also a stronger grasp of their individual subjects.

IV. PROJECT COSTS, FINANCING AND IMPLEMENTATION

A. Costs

4.1 The total cost of the project is estimated at US$60.0 million equivalent net of duties and taxes. The estimated cost by project component is summarized in Table 4.1 and by category of expenditure in Table 4.2. Detailed costs by component and category are given in Annex 7 and project expenditure by year and recipient in Annex 8.

Table 4.1: SUMMARY OF PROJECT COSTS BY COMPONENT

Institution	Won Billion			US$ Million			Foreign as % of Total
	Local	Foreign	Total	Local	Foreign	Total	
Graduate Schools of Natural Sciences	2.6	9.1	11.7	3.8	13.1	16.9	78
Graduate Schools of Engineering	2.6	9.1	11.7	3.8	13.1	16.9	78
Joint Research Facilities	1.6	6.4	8.0	2.4	9.1	11.5	79
Departments of Science Education	0.9	3.1	4.0	1.3	4.4	5.7	77
Baseline Cost	7.7	27.7	35.4	11.3	39.7	51.0	78
Contingencies							
Physical	0.4	1.4	1.8	0.5	2.0	2.5	80
Price Increase	1.2	3.4	4.6	1.6	4.9	6.5	75
Subtotal	1.6	4.8	6.4	2.1	6.9	9.0	77
Total Project Cost /a	9.3	32.5	41.8	13.4	46.6	60.0	78

/a Does not include duties, taxes and fees estimated at US$3.6 million.

Table 4.2: SUMMARY OF PROJECT COSTS BY CATEGORY OF EXPENDITURE

	Won Billion			US$ Million			Foreign as % of Total
	Local	Foreign	Total	Local	Foreign	Total	
Equipment	-	26.6	26.6	-	38.4	38.4	100
Equipment transportation and installation	1.4	0.2	1.6	2.1	0.2	2.3	9
Operation and maintenance	2.8	0.4	3.2	4.1	0.5	4.6	11
Consumable materials	3.5	0.5	4.0	5.1	0.6	5.7	11
Baseline cost	7.7	27.7	35.4	11.3	39.7	51.0	78
Contingencies							
Physical	0.4	1.4	1.8	0.5	2.0	2.5	80
Price Increase	1.2	3.4	4.6	1.6	4.9	6.5	75
Subtotal	1.6	4.8	6.4	2.1	6.9	9.0	77
Total Project Cost	9.3	32.5	41.8	13.4	46.6	60.0	78

4.2 Base costs are estimated at March 1990 prices. Equipment costs are equivalent to the loan amount fixed in the foreign borrowing program inclusive of contingencies. Transportation and installation costs are based on recent experience with these activities in universities and research institutions in Korea. The initial supply of consumables and the costs of operation and maintenance were estimated according to standard procedures in use in these institutions. Duties and taxes, allowing for exemptions, are estimated at US$3.6 million.

4.3 The contingency allowance of US$9.0 million (about 18% of baseline costs) includes contingencies for unforeseen physical conditions and for estimated price increases. Physical contingencies were estimated at 5% of baseline costs for equipment, consumable materials and O&M expenditures. Price increase contingencies were calculated for both local and foreign costs in accordance with the following expected annual average price increase percentages; foreign cost, 7.2% in FY90 and 4.4% p.a. thereafter and local cost, 5.0% p.a. throughout. Accordingly, aggregated price increases are estimated at about 12% of baseline costs plus physical contingencies.

4.4 The foreign exchange component of US$46.6 million (about 78% of total estimated project costs) has been calculated on the basis of the following foreign exchange percentages: equipment - 100%, transportation and installation - 10%, consumables - 10%, and O&M - 10%.

B. Financing

4.5 The proposed loan of US$45.0 million equivalent would finance about 97% of the estimated foreign exchange cost of the project or 75% of total project costs net of duties and taxes. The Government would be responsible for the remaining 25% or US$15 million equivalent. The loan amount is limited to US$45.0 million by the foreign borrowing program and is therefore less than the foreign exchange cost of the project. The loan would finance 100% of the baseline cost of equipment plus all contingencies related to the equipment. Equipment procured under the project for the private institutions would be financed on the basis of subloans by the Government to the institutions on terms and conditions satisfactory to the Bank. The terms of subloans would be the same as those for the Bank loan except that the Government would subsidize half the Bank's interest rate. This subsidy is justified on the basis of the benefits gained from improving basic research programs which would accrue to society in general. The above terms were applied successfully under Loan 2427-KO. Loan funds for the public universities would be passed on as budget transfers by MOE. Loan funds are expected to be allocated in the proportions 20% for private institutions and 80% for public institutions.

Table 4.3: FINANCING PLAN

Category of Expenditure	Government	IBRD	Total
	----------US$ million----------		
Equipment	-	38.4	38.4
Equipment transportation and installation	2.3	-	2.3
Operation and maintenance	4.6	-	4.6
Consumable materials	5.7	-	5.7
Contingencies	2.4	6.6	9.0
Total	15.0	45.0	60.0

Recurrent Expenditures

4.6 When fully operational, the project would generate recurrent costs for consumable materials and O&M estimated at US$4.0 million p.a. This would be spread over approximately 50 institutions thus averaging about US$80,000 per institution. These additional expenditures could be accommodated by the institutions without difficulty.

C. Project Management and Implementation

4.7 Overall responsibility for project management would lie with the Education Facilities Bureau (EFB) of MOE - an agency which has gained considerable experience in implementing Bank projects through its responsibility for earlier Bank projects including the two sector loans (1800-KO, 2427-KO). Physical aspects of the project would be handled within EFB by the Education Loan Projects Division (ELPD) including relations with OSROK for equipment procurement. Assistance on educational issues would be provided by the University Education office (UEO) of MOE and on research issues by the Science and Technology Education Bureau (STEB) and UEO. The University Education Administration Division (UEAD) of UEO provides the administrative linkage with the universities. The Academic Research and Promotion Division of UEO together with the Science Education Division (SED) of STEB provides the research linkage with the universities. These three divisions with 10, 8, and 13 staff respectively, would perform the additional tasks generated by the proposed project without the need to recruit additional staff. The same applies to EFB presently with 42 staff, including 11 staff in ELPD. A Project Coordinating Committee (PCC), with suitable terms of reference (Annex 4), would be responsible for general oversight of the project. Chaired by EFB and including senior officers of UEO and STEB, the PCC would provide policy advice and resolve any major problems which might arise during project implementation. It would begin to function immediately after loan signing. The PCC would also be responsible for advising the Vice-Minister, MOE on the selection of participating universities and research projects to be included under the project. The PCC would be advised on the selection of research projects and associated equipment lists by expert panels with variable membership determined by the field of research under discussion. The panels would review research proposals, rate them according to the selection criteria and make appropriate recommendations to the PCC. The Vice-Minister, MOE, would have final approval on the selection of institutions and research projects. These procedures are represented diagrammatically in Annex 5. An organization chart for MOE is given at Annex 6.

4.8 The Education Loan Projects Division would be responsible for routine correspondence and reporting to the Bank, and for financial and disbursement matters. ELPD would also act as the link between the project institutions and OSROK on equipment procurement matters. ELPD has played this role in previous Bank projects and is staffed with experienced procurement personnel. However, the bulk of the work in equipment procurement would be undertaken by OSROK, which is also highly experienced in procuring equipment under the Bank's international competitive bidding procedures. On the basis of equipment specifications provided by the institutions through ELPD, OSROK would prepare bidding documents, invite bids, evaluate them in conjunction with ELPD and the institutions and make contract awards with the agreement of the institutions. The universities would be responsible for installation, initial testing and operation of the equipment, unless specified in the equipment contract that the supplier would perform this task. The universities would also be responsible for maintenance and repair of the equipment including acquisition of spare parts, accessories and consumables, beyond the items and services initially supplied under the contract. The Bank would supervise the project twice yearly around March and September coinciding as far as possible with preparation of the semi-annual progress reports (para. 4.15). Overall

implementation issues would be handled by the task manager with technical aspects being the responsibility of a consultant technical educator.

Status of Project Preparation

4.9 The advanced stage of project preparation would allow implementation to commence immediately after loan signing. Criteria for the selection of universities to be included in the project and for the selection of research projects from these universities, together with guidelines for the allocation of loan proceeds, have been prepared and are acceptable to the Bank. The PCC has been identified and agreed terms of reference specified. Project management authorities have been identified and competent staff are available to handle implementation activities.

Procurement

4.10 Procurement arrangements are shown in Table 4.4. About 85% of the equipment would be procured on the basis of international competitive bidding procedures in accordance with the Bank's guidelines. Equipment items in contracts valued at less than US$200,000 may be procured through international or local shopping up to a limit of US$6.8 million. Local equipment manufacturers would be extended a 15% preference margin, or the prevailing customs duties, whichever is the lower, on bid evaluation under ICB. Transportation, operation and maintenance costs of equipment would be financed by the Government under local procedures. Installation costs and costs of consumables, if not included in the equipment contracts, would also be financed by the Government.

Table 4.4: PROJECT EXPENDITURE BY PROCUREMENT CATEGORY

Category of expenditure	ICB	LCB	Other /a	N/A	Total cost including contingencies
	(US$ million)				
Equipment	38.0 (38.0)	-	7.0 (7.0)	-	45.0 (45.0)
Equipment transportation and installation	-	-	-	2.7 (0.0)	2.7 (0.0)
Operation and maintenance	-	-	-	5.5 (0.0)	5.5 (0.0)
Consumable materials	-	-	-	6.8 (0.0)	6.8 (0.0)
Total	38.0 (38.0)	-	7.0 (7.0)	15.0 (0.0)	60.0 (45.0)

/a Includes international and local shopping.

Note: Figures in parentheses are the amounts to be financed by the loan.

4.11 In accordance with successful practices for procurement under ICB used in recent education projects in Korea, OSROK will not be required to refer equipment contracts to the Bank for prior review before making contract awards. However, complete bidding documents including commercial terms, schedule of requirements and technical specifications will be sent to the Bank for reference and record before each invitation to bid. Bid evaluation reports, documents and contracts will be retained by OSROK for selected ex-post review by Bank missions. However, copies of bid evaluation reports and two conformed copies of contracts would be sent to the Bank for its records.

Disbursements

4.12 The proposed loan of US$45.0 million would be disbursed over a period of 5.5 years (Annex 10). This corresponds to the standard profile for education projects in Korea which is 5.5 years. The completion date of the proposed project would be June 30, 1995 and the Closing Date, December 31, 1995. Disbursements would be made on the basis of (a) 100% of foreign expenditures for imported equipment or the ex-factory cost of locally manufactured equipment; and (b) 65% of the cost of other local expenditures for equipment. Disbursement applications involving equipment contracts exceeding $200,000 equivalent will be fully documented. For disbursement against equipment contracts below $200,000, reimbursement would be made against statements of expenditure for which full documentation would be

retained in the project institutions, for review as requested, by visiting Bank missions. Administrative and accounting capability is adequate to support the SOE procedure.

4.13 To facilitate disbursements, a special account, maintained in US dollars would be set up at the Korean Exchange Bank (KEB) in an amount of US$3.0 million to cover the estimated average amount required to finance project expenditures for the next four months. Applications for replenishment of the special account would be submitted to the Bank on a quarterly basis, or whenever the amount requested exceeds 50% of the initial deposit, whichever comes first.

Project Monitoring and Evaluation

4.14 In order to monitor ongoing progress in implementating research projects under the project, the progress reports (para. 4.15) would include every 12 months, the following indicators for each year of the project: number of research projects approved; amount of investment; number of research projects completed; total number of publications; number of publications in international journals; and number of patents awarded. Since research grants selected under the project would be awarded to individual, or groups of, professors, it is appropriate that KRF undertake evaluation of the results of research projects according to the standard procedures KRF uses to evaluate research awards under Category 3 (para. 2.11). During negotiations, the Government agreed to utilize KRF for the evaluation of research projects.

Accounts, Audits and Reporting

4.15 MOE would maintain project accounts in accordance with sound accounting practices. During negotiations, the Government provided assurances that audited accounts and financial statements would be sent to the Bank within six months of the end of each financial year. The Government would submit semi-annual progress reports to the Bank in about March and September, provide status reports for visiting missions, and, within six months of the Closing Date, submit a project completion report.

D. Environmental Impact

4.16 The project will not have any negative impact on the environment. The equipment to be supplied under the project will be located in properly designed laboratories which operate under standard safety procedures.

E. Impact on Women

4.17 The project would have its strongest impact on women through its support for improving the quality of research in the departments of science education. To the extent that improved research will lead to better quality instruction in the departments and since women comprise 48% of enrollments in science education departments then, over time, the project should help to produce better quality female science teachers. On the other hand, improvements in research capacity in the graduate schools of natural sciences and engineering will have a relatively small impact on women since they comprise only 11% of enrollments in science and engineering programs.

V. BENEFITS AND RISKS

A. Benefits

5.1 The project would strengthen the capacity of selected universities to support technological innovation in priority fields by enhancing their ability to undertake basic research. This in turn would help to reduce Korea's dependence on imported technology and in the longer run strengthen its ability to maintain the pace of industrial development and remain competitive in export markets. The project would also strengthen science education in the universities leading in time to higher quality training for science teachers which in due course would strengthen the base of science education in Korea.

B. Risks

5.2 There are no major risks associated with the project.

VI. AGREEMENTS REACHED AND RECOMMENDATION

6.1 The Government has agreed to the following:

(a) project institutions and research projects would be selected and loan proceeds allocated according to criteria and guidelines acceptable to the Bank (para. 3.5);

(b) audit reports would be submitted by the Government to the Bank within six months of the end of each financial year (para. 4.15);

(c) semi-annual progress reports would be submitted to the Bank around March and September and status reports provided to visiting missions (para. 4.15); and

(d) within six months of the Closing Date, a project completion report would be submitted to the Bank (para. 4.15).

6.2 During negotiations, an understanding was reached that the Government would utilize KRF to evaluate the results of research projects included under the proposed project (para. 4.14).

6.3 Subject to the above conditions, the project constitutes a suitable basis for a Bank loan of US$45.0 million equivalent to the Republic of Korea for a term of 15 years, including 5 years of grace at the Bank's standard variable interest rate.

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Criteria for Selection of Participating Institutions

For an institution to be eligible for receipt of loan funds under the project, it must meet the following criteria:

A. Graduate Schools of Natural Sciences and Engineering

(i) The school must be a constituent part of a national, public or private university.

(ii) Size. The graduate schools of natural sciences must have at least three departments; the graduate schools of engineering must have at least four departments.

(iii) Staff. The three or more science departments must include at least 15 faculty members with doctoral degrees and at least 5 in each department; the four or more engineering departments should have at least 20 faculty members with doctoral degrees and at least 5 in each department.

(iv) Student Enrollment. The graduate schools in the year 1989 - 90 must have enrolled at least 60 students in masters' and doctoral programs in natural sciences and 80 in similar programs in engineering; graduate programs must have been in operation for at least three years as of March 1990.

(v) Research Activities. Departments must show evidence of receipt of research grants awarded by KOSEF or other research funding institutions and demonstrate a record of publication in professional journals.

Note. Following experience under Loan 2427-KO, the above criteria may be relaxed somewhat for private universities.

B. Schools of Science Education

(i) The school must be a constituent part of a national, public or private university.

(ii) Size. The school must have at least two departments of science education which were in operation before March 1990. The school's parent institution must have been in operation for at least three years as of March 1990.

(iii) Staff. The two or more departments of science education must each include at least two full-time faculty members qualified to teach subjects in science education.

(iv) Student Enrollment. Each science education department must have enrolled at least 20 new students in the academic year 1989-90.

C. Joint Research Facilities

(i) The facilities must offer common research opportunities in the natural sciences and engineering and have access to university libraries for interchange of academic information.

(ii) The common facilities must be equipped for research in priority fields such as new materials, semi-conductors, bio-engineering, optics, etc. and must be open to researchers from any university.

(iii) The university library associated with the common research facilities must give appropriate emphasis to science and engineering and be linked to other libraries in order to facilitate the flow of research information.

D. All Institutions--Regional Distribution

Selection of institutions in accordance with the above criteria will also reflect a regional distribution so as to conform with "The Guidelines for Allocation of Loan Funds" para. (c), (Annex 3).

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Criteria for Selection of Research Projects

For the Universities Science and Technology Research Project, review and selection of research projects would be based on the following:

Category	Suggested Maximum points to be awarded
I. Research proposal	50
II. Primary investigator(s) and support	40
III. Facilities	10
Total	100

The subheadings for each category are as follows:

I. Research Proposal

(a) purpose and relevance to national and institutional priorities;

(b) content;

(c) approach and methodology;

(d) duration of research;

(e) list of research equipment required and outline specifications, relevance, appropriateness and whether there are alternatives; and

(f) cost estimate.

II. Primary Investigator(s) and Support

(a) qualifications and experience of primary investigator(s);

(b) adequacy and quality of support staff; and

(c) availability of graduate students.

III. Facilities

(a) status of existing facilities in related field(s);

(b) availability of relevant supporting facilities at departmental level, and in the university; and

(c) need for special rooms and/or special arrangements, e. g. ultra-high voltage supply, low temperatures, etc.

Details on point awards related to the subheadings should be further considered, discussed and modified after initial operation.

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Guidelines for Allocation of Loan Proceeds

The following guidelines would be used by the Government for the allocation of loan proceeds to participating universities:

(a) Overall Allocation of Loan Funds. It is expected that overall allocation would not exceed: $15 million for graduate schools of natural sciences; $15 million for graduate schools of engineering; $10 million for joint research facilities; and $5 million for schools of science education.

(b) Concentration of Funds. Within the above ceilings, it is expected that there would be no more than 20 graduate schools participating in science and 20 in engineering; 10 centers having joint research facilities; and 10 schools of science education.

(c) Regional Distribution of Funds. For graduate schools of science and engineering and joint research facilities, at least 30% of their share of loan funds would be allocated to universities outside the Seoul area. For schools of science education, the proportion would be at least 50% to be allocated outside the Seoul area.

(d) Participation of Private Institutions. About 20% of total loan funds would be allocated to private universities.

(e) Maximum and Minimum Allocation per School. In order to ensure a reasonable concentration of funds to participating schools thereby achieving a significant research impact while ensuring a reasonably equitable participation in the project, the following allocation limits would be followed:

School	Maximum	Minimum
Graduate natural sciences	$3 million	$0.75 million
Graduate engineering	$3 million	$0.75 million
Joint facilities	$2 million	$1 million
Science education	$1 million	$0.5 million

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Terms of Reference for the Project Coordinating Committee

1. The Project Coordinating Committee (PCC) of the Ministry of Education (MOE) would consist of the following members:

Director General, Education Facilities Bureau (EFB) (Convenor)
Director General, University Education Office (UEO)
Director General, Science and Technology Education Bureau (STEB), and co-opted members as required.

2. The PCC would meet at least once in every quarter and more often, if necessary. The presence of two of the three above mentioned members (excluding co-opted members) would form a quorum.

3. The PCC would be responsible for general oversight of the IBRD project, provide policy advice to MOE and resolve any major problems which might arise during project implementation.

4. The Education Loan Project Division (ELPD) of EFB would act as the secretariat for the PCC.

5. ELPD would invite proposals for research projects from the participating universities, collate them and submit the proposals to PCC for review.

6. The PCC would appoint as many expert panels as needed for the review of research project proposals. Each expert panel would report to the PCC and make recommendations to the PCC for acceptance or rejection of such proposals. Accepted proposals would each be assigned points, not exceeding 100, in accordance with the Criteria for the Selection of Research Projects.

7. The PCC would rank the accepted proposals according to the point rating and make recommendations to the Vice Minister of MOE in accordance with:

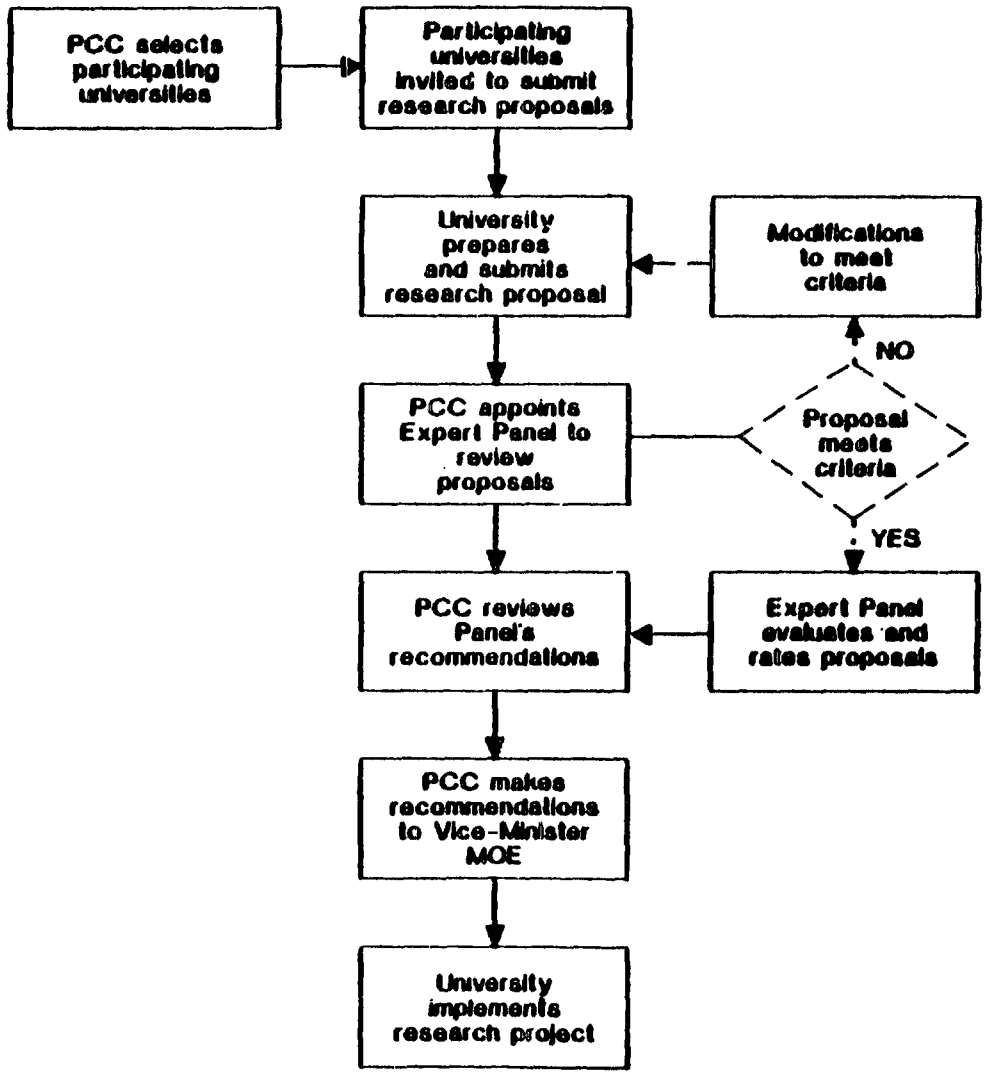
(a) the Procedures for the Selection of Research Projects; and

(b) the Guidelines for the Allocation of Loan Proceeds to finance proposals selected and approved by the Vice Minister of MOE.

8. The universities would be responsible for implementing research projects to be included under the Bank-assisted project. They would keep the PCC informed of progress in research activities at such times as the PCC may require. The PCC reserves the right to terminate loan financing for a research project if, in consultation with the university authorities, it is deemed that the project should not be continued.

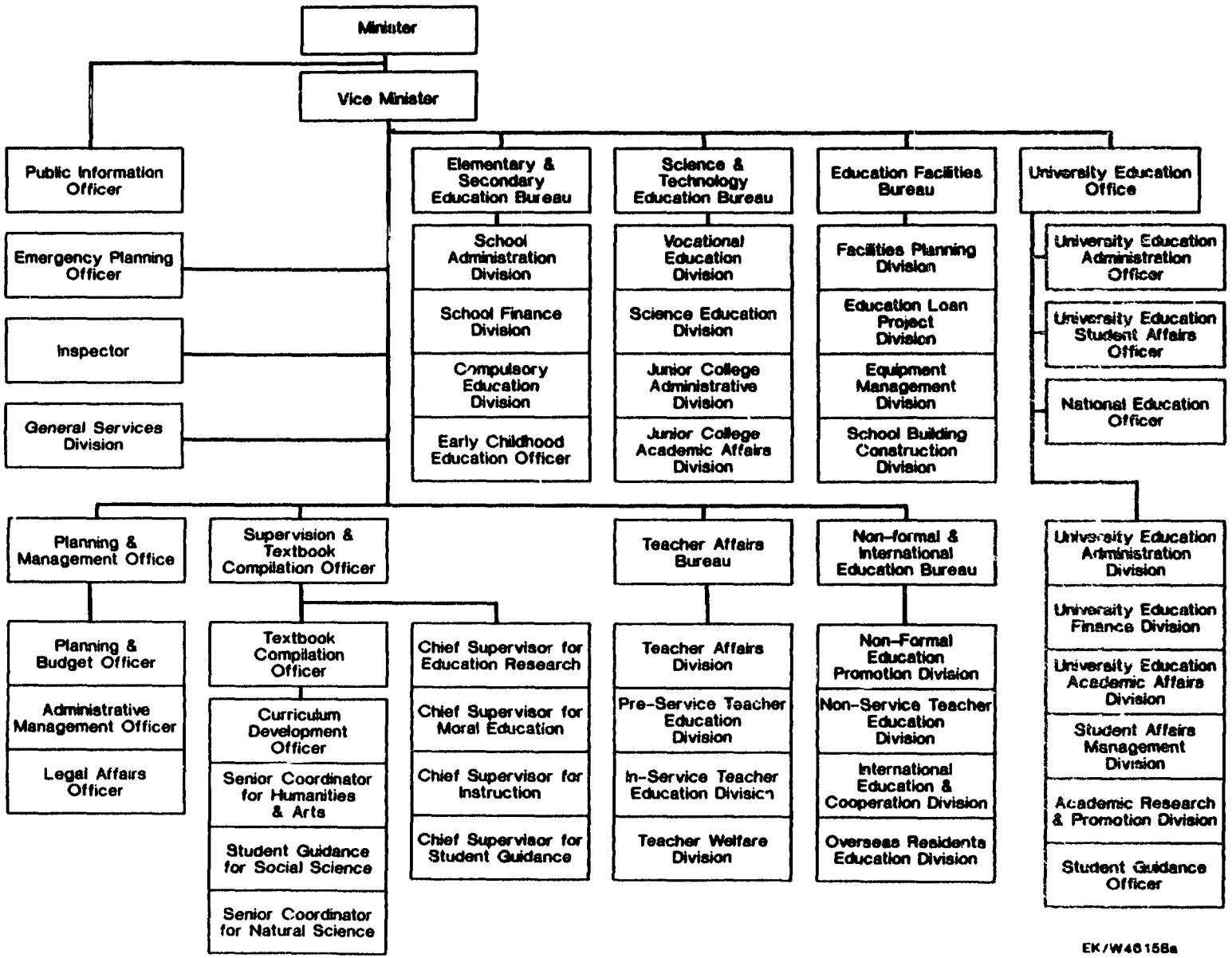
9. The PCC would receive from KRF evaluation reports of completed research projects through its secretariat (ELPD). The PCC would make recommendations, if necessary, to the Vice Minister of MOE for disseminating research results to other institutions or to industry for application and development. All fees from licenses, patents, etc. which might result from the research projects would accrue to the university responsible for the research project.

KOREA
UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT
Procedures for Selection of Research Projects



ANNEX 5

KOREA
UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT
Organization of the Ministry of Education



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ANNEX 6

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Detailed Project Costs
(Won million)

Institution	Equipment	Equipment transportation and installation	O&M	Consumable materials	Total Cost Won M	Total Cost US$ M
Graduate Schools of Natural Sciences	8,822	529	1,056	1,320	11,727	16.9
Graduate Schools of Engineering	8,822	529	1,056	1,320	11,727	16.9
Joint Research Facilities	6,019	366	722	876	7,983	11.5
Departments of Science Education	3,010	181	362	444	3,997	5.7
Baseline Cost	26,673	1,605	3,196	3,960	35,434	51.0
Contingencies						
Physical	1,333	80	160	198	1,771	2.5
Price increase	3.274	224	451	553	4,502	6.5
Subtotal contingencies	4,607	304	611	751	6,273	9.0
Total Project Cost						
Won million	31,280	1,909	3,807	4,711	41,707	
US$ million	45.0	2.7	5.5	6.8		60.0

ANNEX 7

KOREA

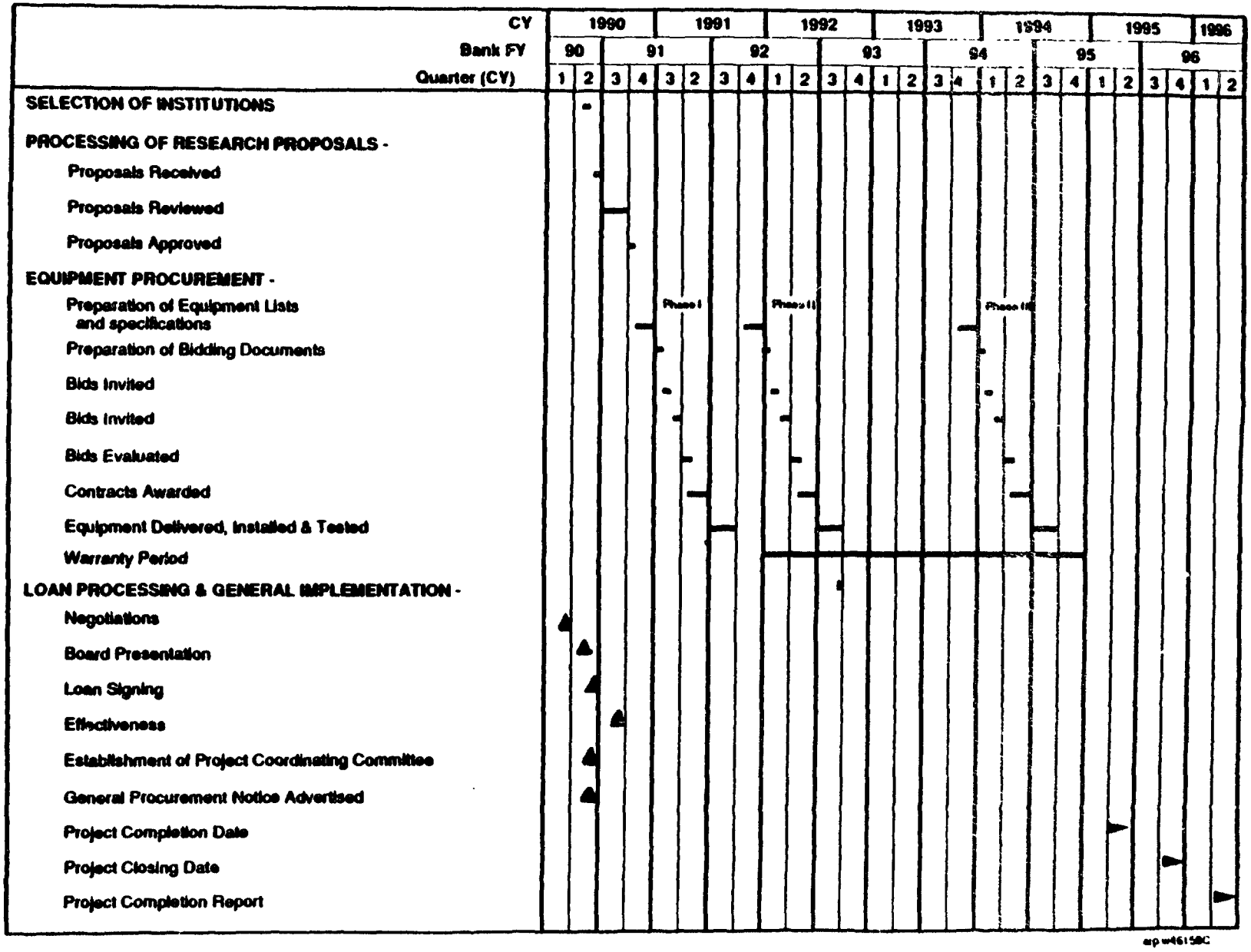
UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Project Expenditure by Year and Recipient

Schools	Base Costs (Won million) 90/91	91/92	92/93	93/94	94/95	95/96	Total Cost Won m	US$ m
Graduate Schools of Natural Sciences	820	2,780	4,504	2,316	1,203	104	11,727	16.9
Graduate Schools of Engineering	820	2,780	4,504	2,316	1,203	104	11,727	16.9
Joint Research Facilities	568	1,848	3,017	1,633	820	97	7,983	11.5
Departments of Science Education	285	925	1,508	819	369	91	3,997	5.7
Baseline Cost	2,493	8,333	13,533	7,084	3,595	396	35,434	51.0
Contingencies								
Physical	124	417	676	354	180	20	1,771	2.5
Price increase	59	603	1,640	1,250	834	116	4,502	6.5
Total Project Cost	2,676	9,353	15,849	8,688	4,609	532	41,707	60.0
Foreign Exchange	2,089	7,271	12,360	6,775	3,583	387	32,465	46.6

ANNEX 8

KOREA
UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT
Implementation Schedule



ANNEX 9

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Disbursements

IBRD fiscal year & semester	Amount per semester	Cumulative Amount	Cumulative %	Disbursement profile /a
	(US$ million)			(%)
1991				
1	3 /b	3	7	1
2	0	3	7	3
1992				
1	5	8	18	5
2	6	14	31	10
1993				
1	8	22	49	23
2	9	31	69	44
1994				
1	5	36	80	70
2	4	40	89	81
1995				
1	3	43	96	92
2	1.5	44.5	99	97
1996				
1	0.5	45.0	100	100

/a Standard disbursement profile for education projects in Korea.

/b Initial deposit in Special Account.

KOREA

UNIVERSITIES SCIENCE AND TECHNOLOGY RESEARCH PROJECT

Selected Documents Available in the Project File

A. Reports and Studies Related to the Sector/Subsector

A-1* Introduction to Science and Technology - Republic of Korea, MOST, 1988

A-2* Korea - Sector Survey of Science Education, IBRD, January 12, 1982

A-3* Impact of World Bank Lending for Educational Development in Korea: A Review, IBRD Report No. 5950, December 5, 1985

A-4* A Study on the Long Term Development Plan of Graduate Education in the Field of Science and Engineering in Korea, MOE, July 1985

A-5 A Study on the Optimal Standards for Higher Education Facilities in Korea, KCUE, April, 1985

A-6 A Study on the Efficient Expansion Program of Educational Equipment and their Quota System and Common Utilization Plan, MOE, December 26, 1987

A-7 The Feasibility Study on the Promotion of Research and the Expansion of Research Facility in the Areas of Advanced Science and Technology, MOE, May 1985

A-8 A Study on the Expansion Plan of Research Facilities in Gradute Education, MOE, April 1986

B. Reports and Studies Related to the Project

B-1 Universities Science and Technology Research Project, MOE, June 1989

B-2 Equipment Needs Program, NOW, October 1989

C. Selected Working Papers

C-1 IBRD Working Paper - Equipment

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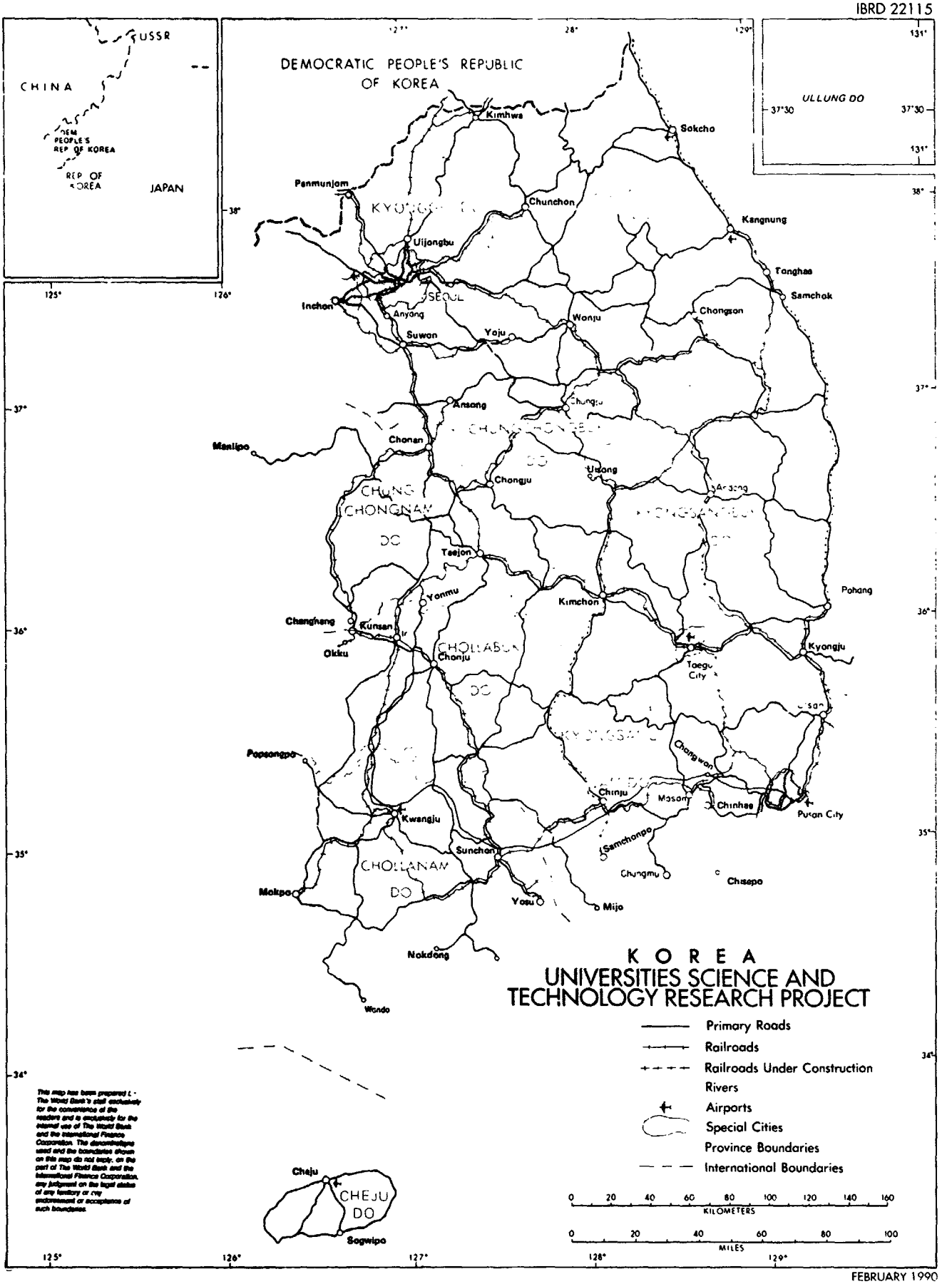
* - to be found in the Project File for the First Technology Advancement Project (Loan 3037-KO).



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